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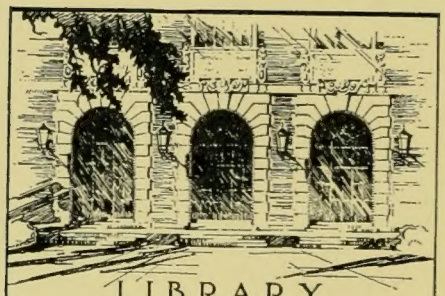

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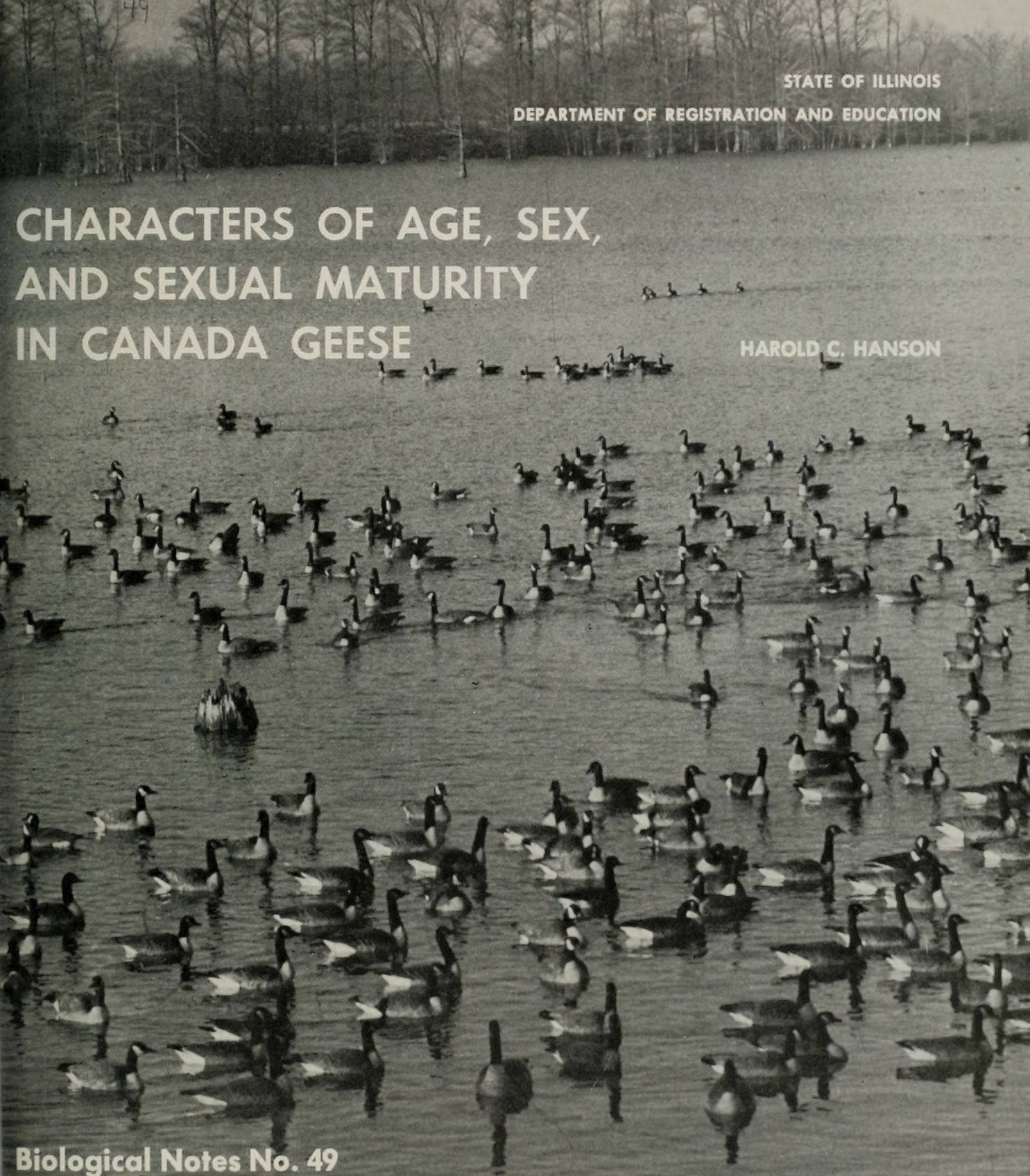
CHARACTERS OF AGE, SEX, AND SEXUAL MATURITY IN CANADA GEESE

HAROLD C. HANSON



Biological Notes No. 49
Reprinted with revisions
June, 1967

NATURAL HISTORY SURVEY DIVISION
Urbana, Illinois

Fig. 1. — Cree Indian guide on the breeding grounds of the Canada geese that winter in Illinois. Goose nests of the type shown here are common on the breeding grounds in the Hudson Bay region of northern Ontario, Canada.

CHARACTERS OF AGE, SEX, AND SEXUAL MATURITY IN CANADA GEESE

HAROLD G. HANSON

The base upon which the year-to-year management of a wild goose population must rest is a collection of accurate data on the age and sex of individuals in the population. Age and sex data collected during the fall and winter period can be used to make fairly accurate estimates of the productivity of a population in the previous nesting season and the probable number of geese that will be returning to the wintering grounds in the following autumn (Hanson & Smith 1950:170–171, 192). The validity of these estimates is in large measure dependent on the ability to distinguish yearling adults from older adults as well as from immatures. External morphological criteria useful in aging and sexing Canada geese, *Branta canadensis,* in autumn and winter were summarized earlier (Hanson 1949). Subsequent studies on both the wintering and breeding grounds have provided additional criteria and established their relative values at various seasons of the year.

ACKNOWLEDGMENTS

In making the studies reported here, the writer received the support of many organizations and individuals. Studies at the Horseshoe Lake State Wildlife Refuge, Alexander County, Illinois, benefited greatly from the outstanding facilities and co-operation provided by the Illinois Department of Conservation. Field studies conducted in the Hudson-James Bay region of northern Ontario, on the breeding grounds of the Mississippi Flyway population of Canada geese, *Branta canadensis interior,* were made possible by a series of grants from the Arctic Institute of North America. Logistic support was provided by the Ontario Department of Lands and Forests. An opportunity to study the population of *Branta canadensis maxima* wintering at Rochester, Minnesota, was offered by the Minnesota Department of Conservation and the U.S. Bureau of Sport Fisheries and Wildlife. (Prior to the writer's rediscovery of this race in January, 1962, *B. c. maxima* had been thought to be extinct since about the turn of the century.) Studies of skin collections were made at the American Museum of Natural History, the National Museum of Natural History, and the Chicago Museum of Natural History. The interest and encouragement of Dr. Thomas G. Scott, Head of the Section of Wildlife Research, Illinois Natural History Survey, has been important to the success of the author's long-term study of the Canada goose. The presentation of the findings has benefited from the reviews of the editorial board of the Section of Wildlife Research and the editing of James S. Ayars, Technical Editor of the Survey.

Dr. A. V. Nalbandov of the College of Agriculture, University of Illinois, kindly provided the gonadotropic hormone used in an experiment mentioned later in this paper.

The photograph used for the cover of this publication shows Canada geese on Horseshoe Lake, Alexander County. This and most other photographs reproduced here were taken by the author; photographs for Figs. 9 and 11 were made by Wilmer D. Zehr, Natural History Survey photographer.

MATERIALS AND METHODS

Present findings are based on trap and/or bag samples of Canada geese at Horseshoe Lake, Alexander County, Illinois; at Rochester, Olmsted County, Minnesota; in northern Ontario along the Sutton River, Fig. 1, which drains into Hudson Bay; and on Akimiski Island in James Bay.

In the subsequent discussions, the following age classification is used for Canada geese during the fall and winter period: *immatures,* 5–8 months of age; *yearlings,* 17–20 months of age; and *adults,* 29 or more months of age. During the spring and summer, four age classes of Canada geese can be recognized: *goslings, yearlings, 2-year-old adults,* and *old adults* (not all 2-year-old geese can be separated from older adults). Except as noted, the discussions below pertain to sexing and aging geese during the fall and winter period.

Immature Canada geese can be separated from older geese on the basis of plumage characters alone, but, for the identification of yearlings and for sex determination, the cloaca must be inspected. Another character useful in age and sex identification is the extensor portion of the carpometacarpus of the wing which, in the male, tends to form a bony spur or knob from repeated injury as the bird ages.

Although this paper deals primarily with the characteristics of the Hudson Bay Canada goose (*Branta canadensis interior*) after attaining flight stage, photographs of growth stages of gosling giant Canada geese (*Branta canadensis maxima*) are included at the end of this second printing, Fig. 13.

PLUMAGE CHARACTERS

The tail feathers, the primary feathers of the wing, and the feathers of the breast and belly are all useful in determining age in Canada geese.

Tail Feathers.—The frayed or notched tip in the tail feathers of immature waterfowl, first shown to be a character of age by Beebe & Crandall (1914) and later described by Schiøler (1924) and others, has been widely employed by waterfowl biologists as a criterion of age (Elder 1946:98; Hanson 1949:179), Fig. 2. In most instances, the tail feathers of the first postnatal plumage may be readily differentiated from those of the adult plumage by their narrower, more tapered outline and their less intense pigmentation. During the winter, the tail feathers of the immature plumage are gradually replaced by the longer, broader, and more deeply pigmented tail feathers characteristic of adult plumage. The tail feathers are generally replaced two at a time, beginning with the central pair. In immature Canada geese in southern Illinois, replacement of tail feathers in winter is largely limited to the central two or three pairs. Observations made in early May, 1959, on the breeding grounds of these geese in northern Ontario, revealed that the tail feather criterion of age could be employed, with nearly comparable accuracy, during

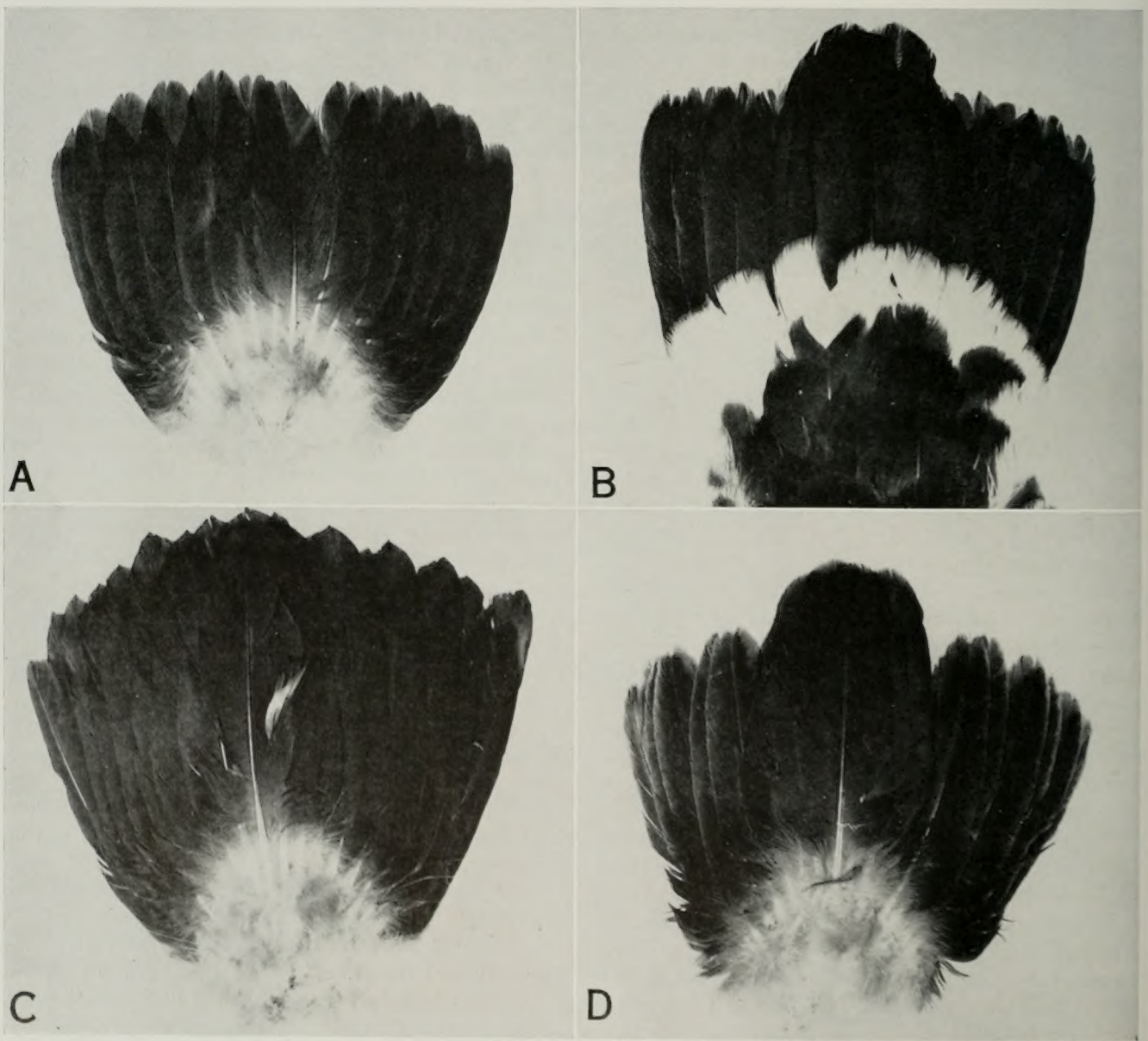


Fig. 2. — Tail feathers of Canada geese: *A* and *B*, immatures in winter; *C*, adult in winter; *D*, immature in early May. A notched tip is evident in most of the feathers of the immatures.

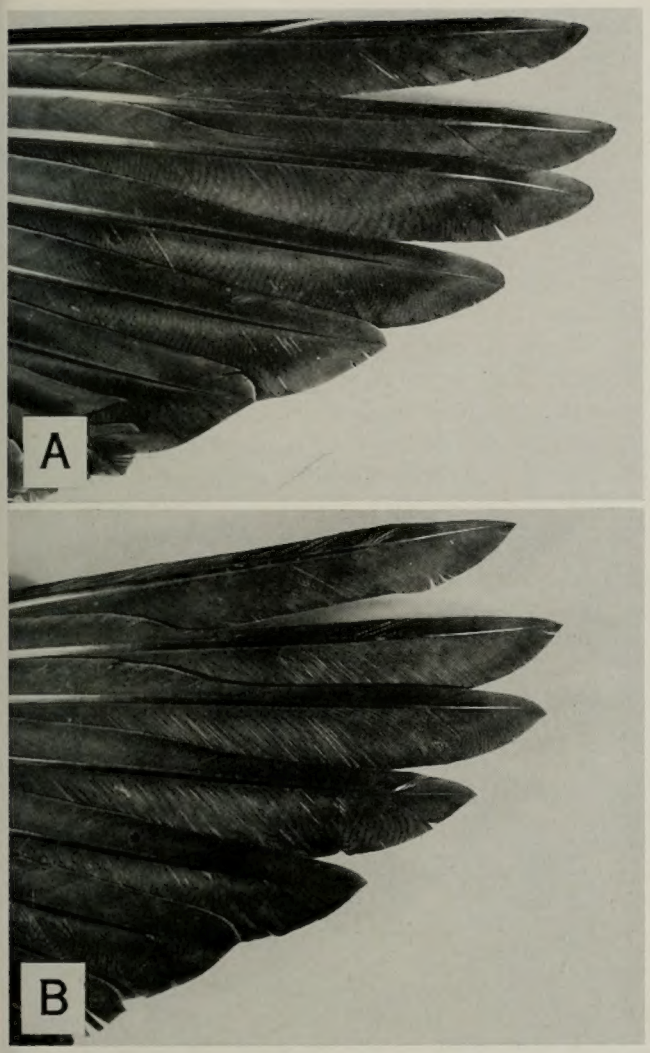


Fig. 3. — Primary feathers of an adult Canada goose, *A*, and an immature, *B*, in winter. Feather tips of the adult are rounded; those of the immature are pointed.

the migration period, the last half of April and the first half of May. Most yearlings retained some immature type tail feathers until the onset of the molt.

The above findings apply particularly to *Branta canadensis interior* of the Mississippi Flyway. That they do not apply equally well to all races of Canada geese became apparent in late January, 1962, when 100 individuals of the subspecies *B. c. maxima*, the giant Canada goose, were examined by the writer at their major wintering area, the city park of Rochester, Minnesota, and the nearby surrounding countryside. Plumage characters of the immature *B. c. maxima* at Rochester revealed these geese to be in a much more advanced stage of development at a comparable date than the immatures of *B. c. interior* in southern Illinois. The tail molt was especially well advanced in the Minnesota birds; at least 5 of the 40 immatures examined had a complete set of adult-type tail feath-

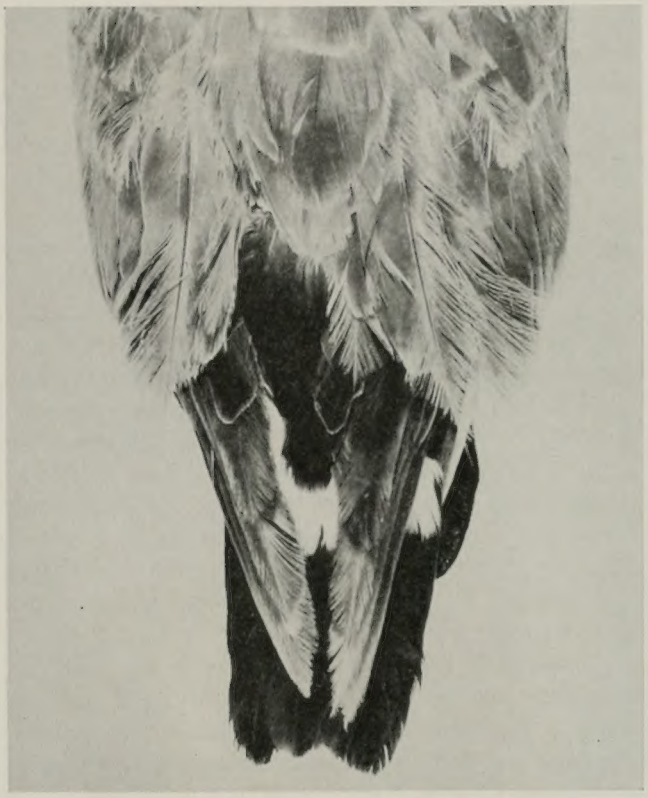


Fig. 4. — Dorsal view of lower back and tail of a lesser Canada goose, *Branta canadensis parvipes*, shot at Perry River, Northwest Territories, on July 3, 1949. The faded, pointed primaries of the immature plumage contrast with the black, adult-type tail feathers.

Fig. 5. — A late-hatched immature Canada goose that still retained, in late February, the breast feathers of the juvenile plumage. The prominence of the shaft in each feather gives the breast a streaked appearance.

ers. This difference is not surprising, as *B. c. maxima* breeding on Dog Lake, Manitoba, build nests (Klopman 1958:169) at least a month earlier than *B. c. interior*, which nest in the Hudson Bay lowlands of northern Ontario and Manitoba. It is advisable to consider both the nesting phenology and the characteristics of the individuals of populations before using collections of tail feathers to obtain age ratios.

Primary Feathers. —When some of the immature geese in a population have a complete set of adult-type tail feathers in winter, the outermost primary feathers of the wings fortunately provide the investigator with a reliable guide to age determination. The primaries of the immature are pointed; those of the adult are obtuse or rounded, Fig. 3. Cloacal characters in wintering birds provide a nearly infallible guide for distinguishing immature males from adult males; however, the cloacal difference between immature and yearling females is largely limited to the depth of the bursa, which is variable.

The use of the primary feathers of the wing for age determination probably has its greatest potential value in taxonomic studies of museum skins. In making a recent study, in various museums, of the skins of races of Canada geese, the author noted specimens that were labeled as to sex but not age or that were incorrectly aged. In these instances a preliminary age determination was made by inspection of the tail feathers and, if these were of the adult type, a conclusive determination was made by inspection of the tips of the primary feathers. Primaries of geese collected in late spring or early summer prior to the molt are usually badly faded by the sun, particularly those of immatures. Being pointed and badly faded, the tips of the primary feathers of the immatures stand out in sharp contrast to the fresh, black tail feathers, Fig. 4, which usually are not attained in full complement until at least midwinter, several months after tail feathers of adults have completed growth.

Breast and Belly Feathers.—Taverner (1931:31) and Elder (1946:101) have pointed out that breast and belly, or contour, feathers can serve to differentiate immatures from older geese. Breast feathers in the juvenile and postjuvenile plumages of immatures are narrower than in subsequent plumages. They are readily recognized by the prominence of the shaft in each feather, which gives the breast a streaked appearance, Fig. 5. Usually these feathers are replaced during the first winter of life by broader contour feathers, which give the underparts a smoother appear-

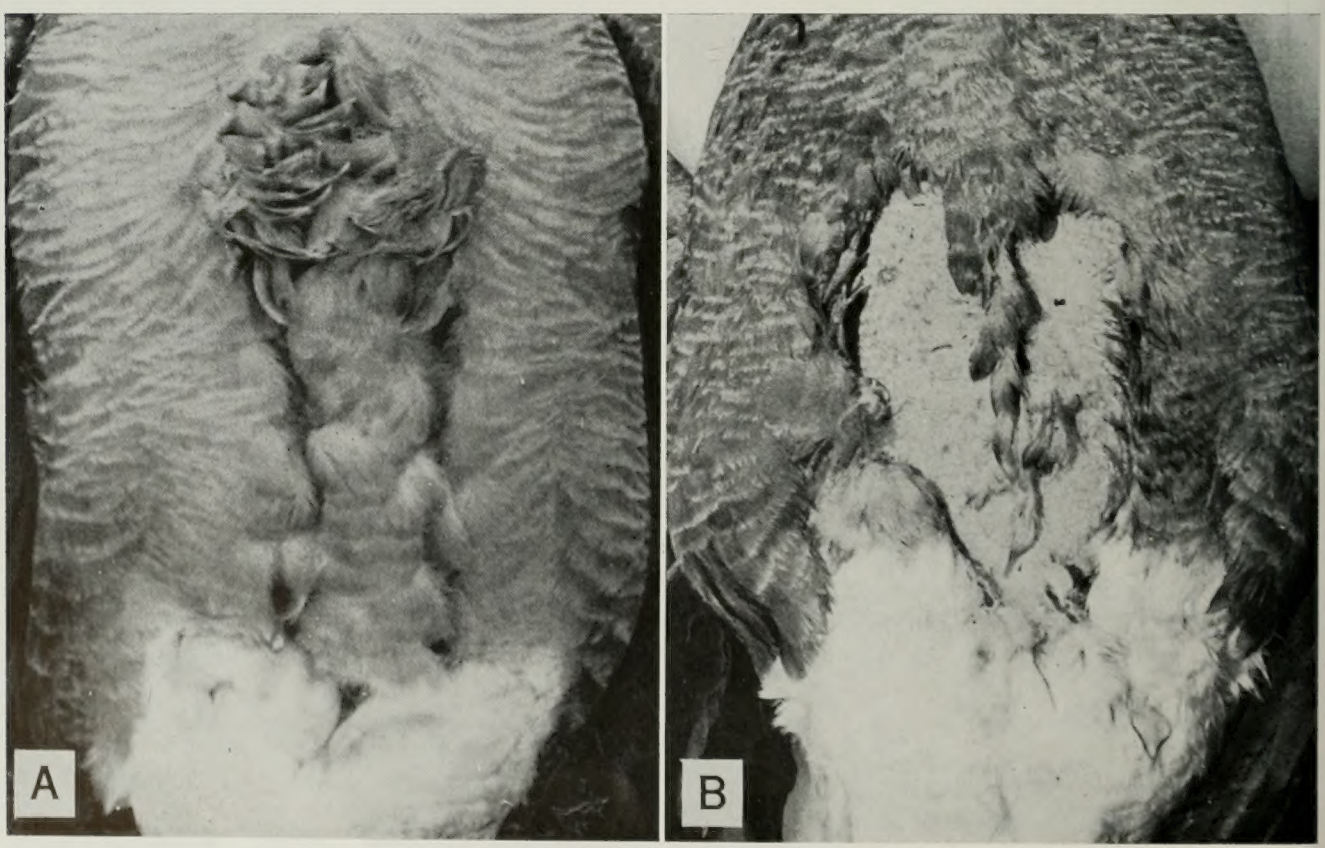


Fig. 6. — Incubation patches of adult female Canada geese during early stages of incubation: *A*, a 2-year-old with a clutch of three eggs, June 3; *B*, an old adult with a clutch of seven eggs, May 28.

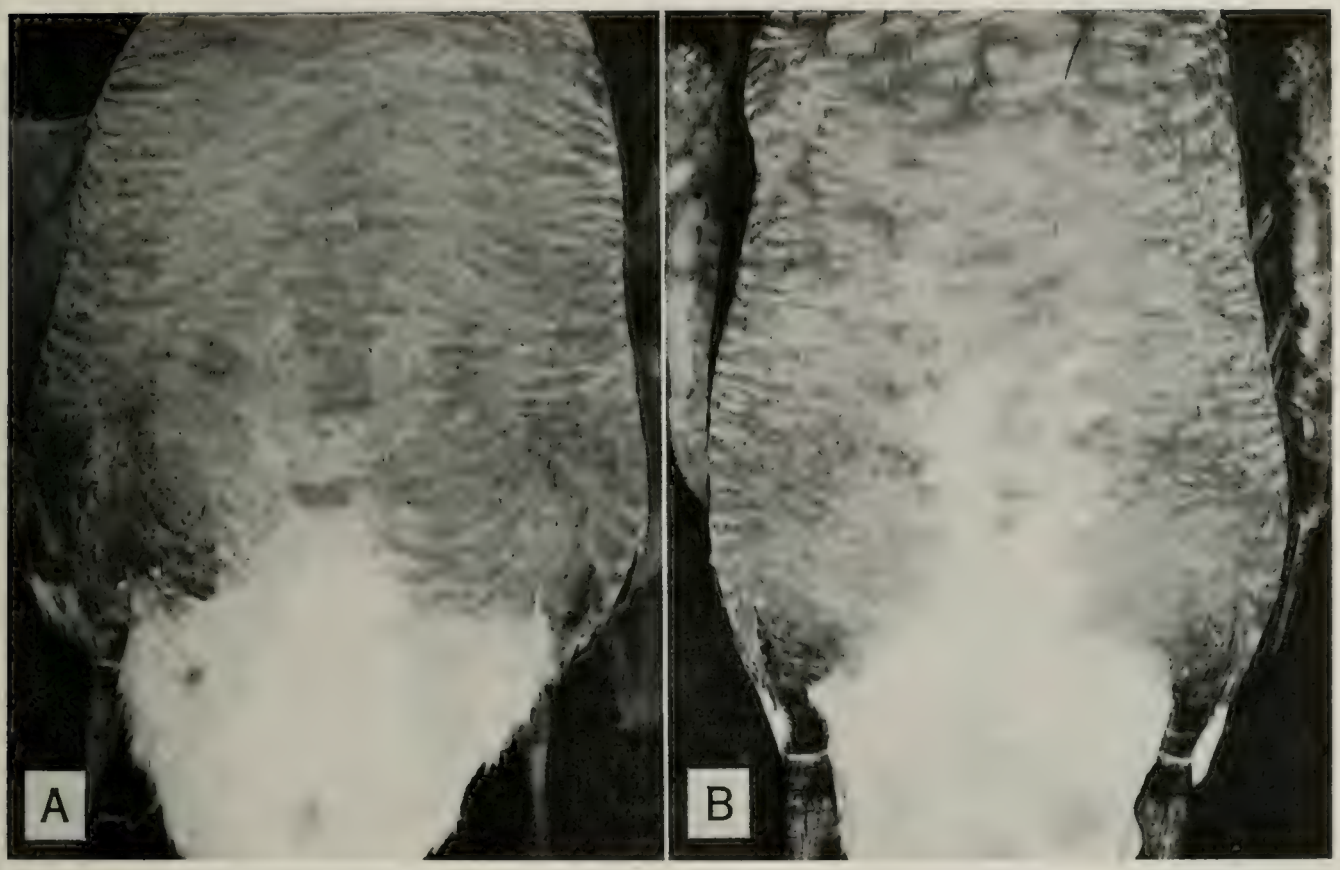


Fig. 7. — Adult female Canada geese in winter with, *A*, partially pigmented and, *B*, unpigmented contour feathers on sites of former incubation patches.

ance and a more even coloration. Geese in their second winter of life, and older geese, have wider—and somewhat stiffer—breast feathers. Although differences in shape, coloration, and texture of breast feathers might possibly prove useful in aging geese if no other characters were available, the time required for accurate age determination from these feathers does not make their use an efficient technique.

In late spring and the early part of summer, a sexually mature female that has produced eggs can be distinguished from a sexually immature yearling and from a nonproductive, older adult female by the presence, on the lower breast and belly, of a bare or partially bare area known as an incubation patch, Fig. 6. This area, from which the female has pulled feathers during the incubation period, is subsequently refeathered. By the onset of the wing molt, or shortly thereafter, when the incubation patch has become refeathered, the fresh, unfaded, and unworn feathers stand out in sharp contrast to the worn and faded feathers of the rest of the breast and belly. The patch feathers, therefore, serve to identify a productive female throughout the flightless period in summer. After this period, the remaining old feathers of the underparts of the body are replaced by new feathers, and the feathers of the patch area may become indistinguishable from the rest of the underparts. In a small percentage of females, the patch area produces some white or atypically colored feathers, Fig. 7. These feathers are retained until the next spring and hence, during the winter period, indicate the site of the previous incubation patch (Hanson 1959:145).

THE WING SPUR

The extensor portion of the carpometacarpus bone of the wing can be used in aging geese. In the immatures and yearlings of both sexes in the wintering populations, the skin at this portion of the wing remains feathered, Fig. 8*A*. In adult females, the tip may be partially bare as a consequence of earlier nesting activities. In sexually mature adult males, the tip of the extensor portion of the carpometacarpus is enlarged and sometimes notably knobby, and the skin over it is usually partially denuded of feathers, Fig. 8*B*. This condition is a behavioral or anatomical artifact, the result of repeated injury in fights with other adult males. The development of a clublike tip to the extensor serves to increase the effectiveness of the wing as a weapon of defense.

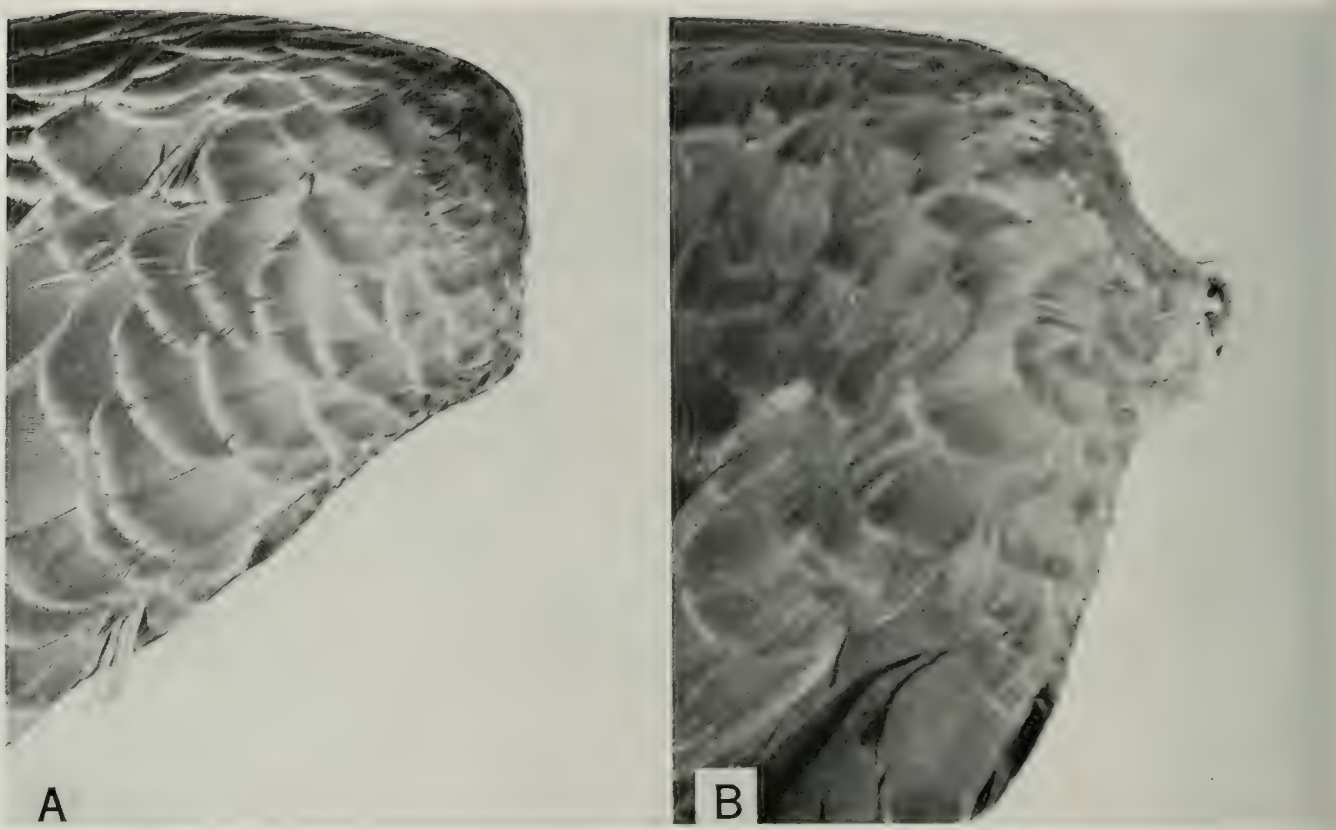


Fig. 8. — Wing of yearling male Canada goose, *A*, and of an adult male, *B*. The enlarged, knoblike portion of the carpometacarpus of the adult is conspicuous.

THE CLOACA

Within the past quarter century, characters of the cloaca have become widely recognized as criteria of sex and age in waterfowl (Gower 1939; Hochbaum 1942; Elder 1946; Hanson 1949). A Canada goose can be most easily subdued for examination of the age and sex characters of the cloaca if the goose is held upside down on the operator's lap and the breast of the bird is firmly tucked under the operator's chest.

The goose can be readily placed in this position if the operator grasps the bird across the humeri with one hand so that the front of the bird is toward the operator. The bird is in position to be placed on the operator's lap with a half-turn of his hand. If the bird is first held so that it faces away from the operator, it must be turned end over end to be in position for examination. It is awkward to handle a goose in this manner, and the abrupt change in position causes the bird to increase its struggles. The struggles of a bird being held can be greatly minimized if its head and neck are tucked under one wing.

Internal examination of the cloaca with the aid of a nasal speculum, Fig. 9, is relatively simple provided the goose is securely held. A metal rod about 2 mm in diameter and with a smoothly rounded tip should be used as a probe. Extending the cloaca greatly facilitates probing for the bursa. The oviduct attaches to the left wall of the cloaca about 15 mm below the sphincter muscle. To explore the cloaca for an opening to the oviduct, the operator should hold the speculum at right angles to the axis of the bird's body. The site of attachment of the oviduct is most easily inspected if the probe is held nearly parallel to the left wall of the cloaca and moderate lateral pressure is used to stretch and smooth out the tissue in that area. A speculum can be used with no harm to the bird if the cloaca is spread open rapidly and firmly. Repeated, gingerly made attempts, in addition to causing the bird to struggle, are apt to rupture small blood vessels.

The Sphincter Muscle.—The size, conformation, and color of the external bare area of the sphincter muscle, Fig. 10, provide some immediate clues to the age and sex of the bird being handled. In immatures of both sexes, the sphincter muscle is flat, small in diameter, and pink-red in color. In yearlings, in winter, the bare area is somewhat larger and may be slightly darker in color. In older, sexually mature geese, the sphincter muscle is usually a darker red or varying hues of purple. Adult males can usually be distinguished from adult females by the marked convexity of the muscle in the males. In adult females, the bare

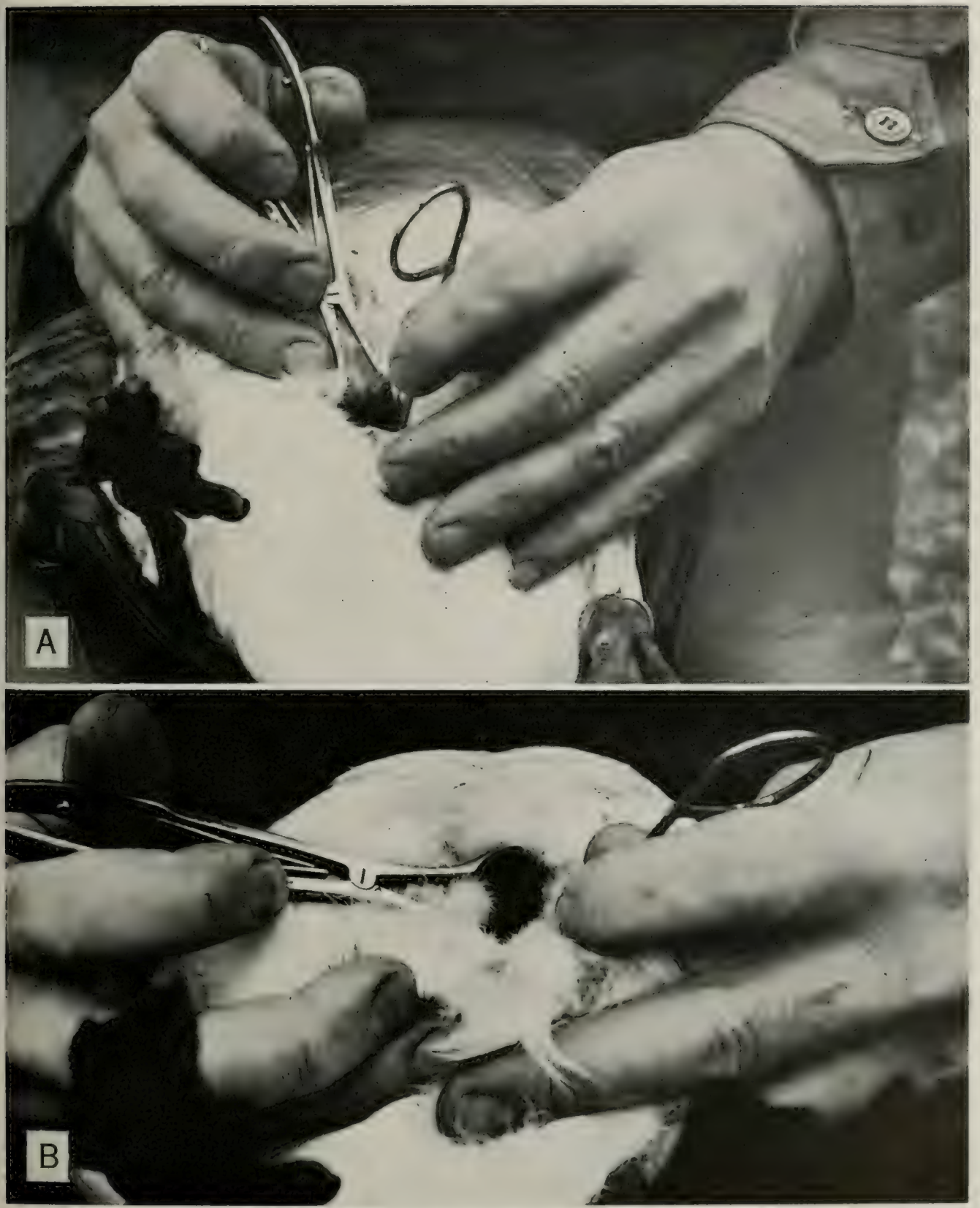


Fig. 9. — *A*, method of using speculum and probe to explore the proctodeum of the cloaca of a Canada goose for presence or absence of a bursal opening; *B*, method of exploring the cloaca to determine whether or not the oviduct is open at its juncture with the cloaca.

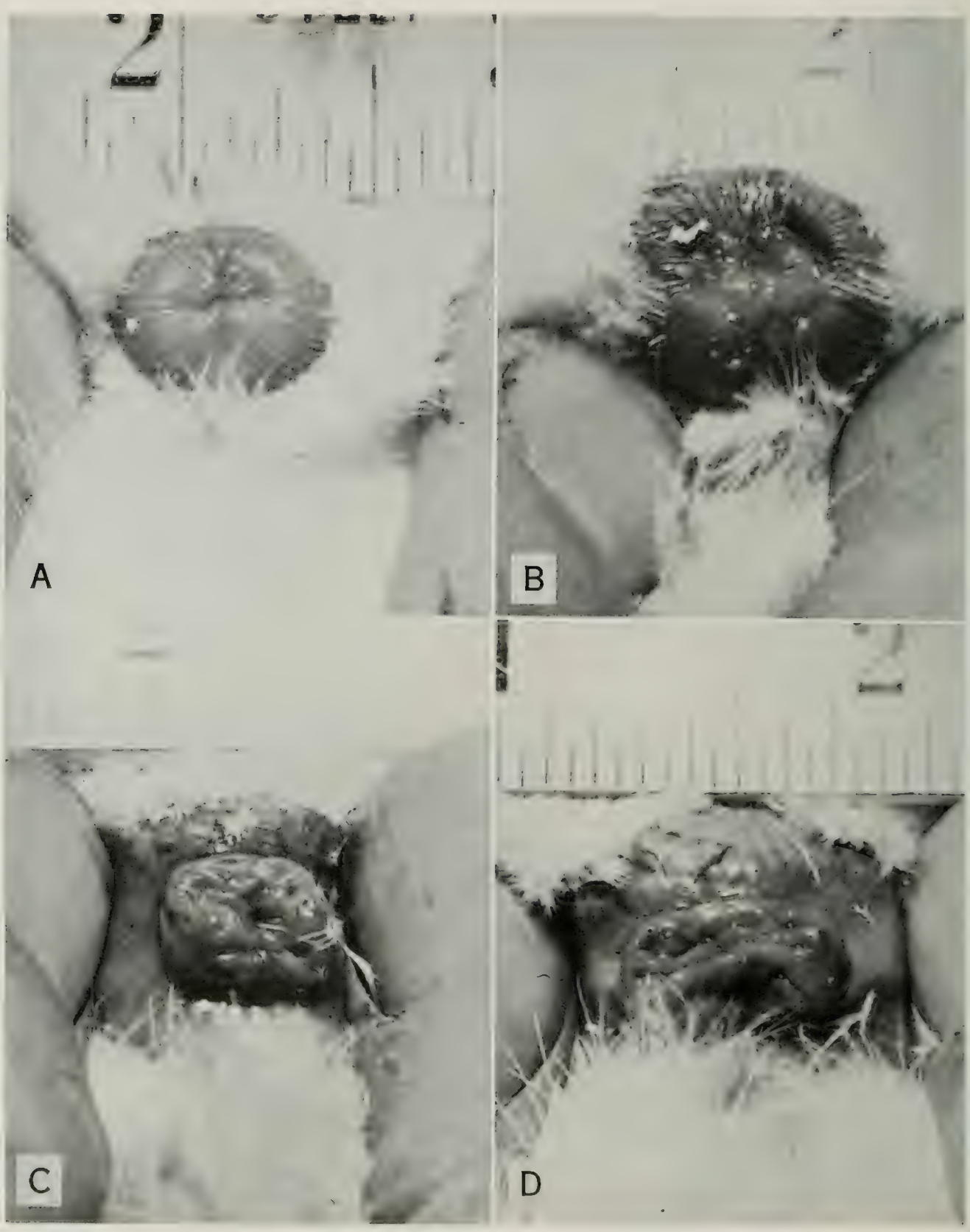


Fig. 10. — Anal sphincter muscles of female Canada geese in winter: *A* and *C*, immature; *B* and *D*, adult; *A* and *B*, the muscle in repose; *C* and *D*, the muscle partially everted.

area of the muscle is particularly large and flat in cross section, Fig. 10*B* and *D*, and the extent to which it can be readily everted usually distinguishes females of this age class from yearling females, Fig. 10*A* and *C*.

The Bursa of Fabricius.—Use of the bursa of Fabricius to distinguish immature from older waterfowl has been described, with reference to ducks, by Gower (1939:427) and by Hochbaum (1942:304–306) and, to Canada geese, by Elder (1946:106–108). Because Canada geese require a longer period to become sexually mature than do most common species of ducks, the bursa of Fabricius is a useful age criterion for distinguishing yearling geese, in winter, from sexually mature adults (Hanson 1949:179–180).

The depth of the bursa in immatures ranges between 24 and 35 mm. The average is about 27 mm. In yearlings, it varies between 15 and 24 mm and averages about 20 mm. The bursa is either closed or has been resorbed in approximately 58 percent of geese in their third winter of life; the remainder have a bursal depth varying from 17–21 mm and an average depth of 15 mm. Penis characters must be especially carefully evaluated in aging these males. As a criterion of age in Canada geese, the bursa is of value chiefly in separating yearling from older geese, but it must be used in combination with other cloacal characters. Absence of the bursa can be considered quite certain evidence that a goose is 2½ or more years of age.

Closure of the bursal opening into the proctodeum of the cloaca apparently proceeds most rapidly during the second year of life, that is, in the age group achieving sexual maturity in the third spring of life. A female, Fig. 6*A*, shot along the Sutton River, Ontario, near the coast of Hudson Bay in early June and judged to be nesting for the first time, had a clutch of three eggs, a very restricted incubation patch, and a bursa that had membranous walls that could be probed only with difficulty. She was judged to be nearly 2 years of age.

The Oviduct.—In female Canada geese, the membrane that occludes the opening of the oviduct into the cloaca is usually not resorbed until after the geese

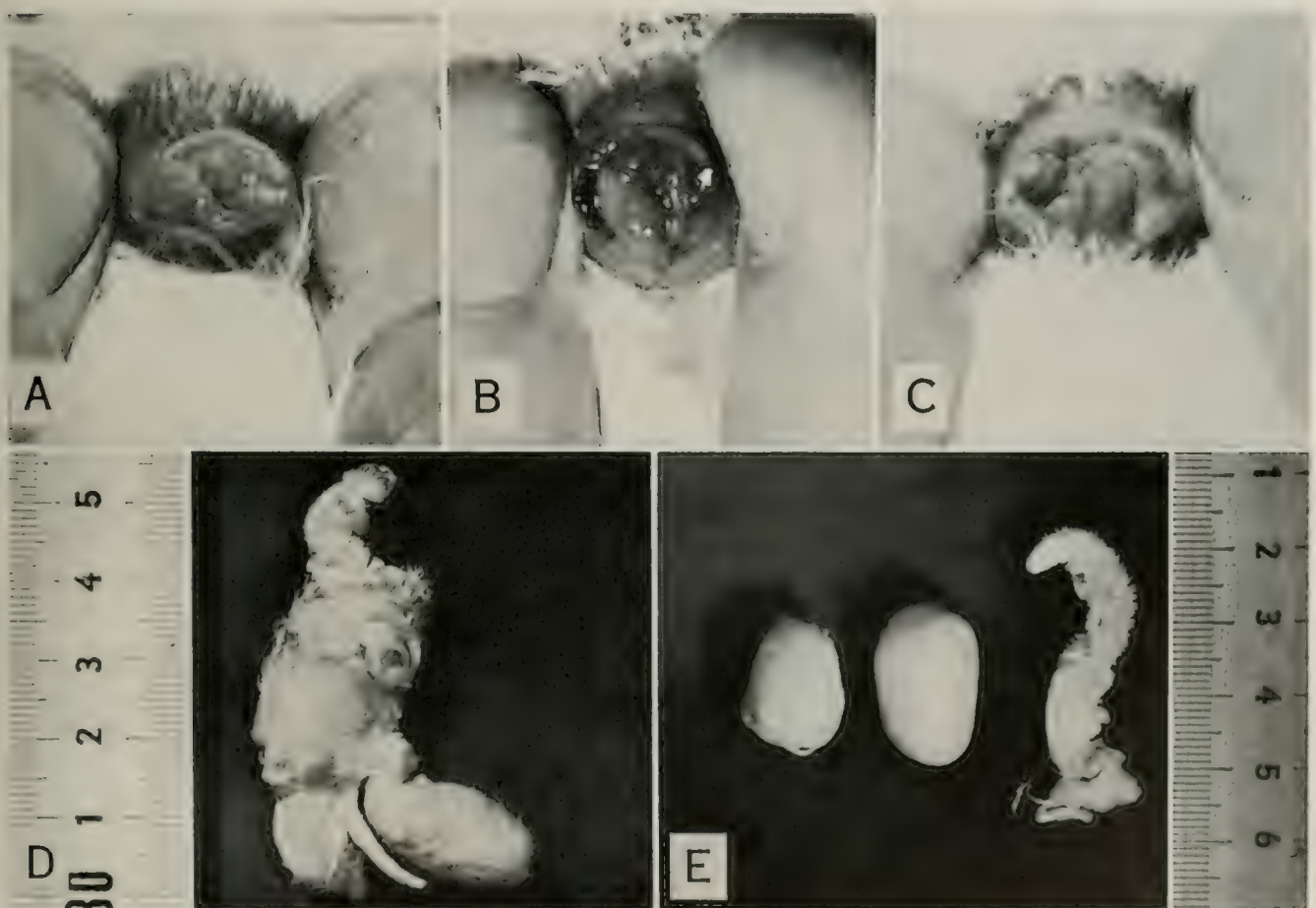


Fig. 11.—Penis of, *A*, an immature Canada goose during the first winter of life; *B*, a yearling during its second winter of life; and, *C*, an older adult in winter. The stage of development the penis a yearling, *D*, attains during its second spring of life (an immature the previous winter) is nearly comparable to that attained by an adult, *E*, in spring.

have left their wintering grounds in their third spring of life. Therefore, determining the presence or absence of an occluding membrane at the juncture of the oviduct with the cloaca is the best way, in winter, to distinguish females approximately 1½ years old from older females. Accurate age determination is of singular importance if the success of the past breeding season is to be estimated from age and sex ratios obtained from trapped birds prior to the hunting season. Studies conducted in preparation for an earlier report (Hanson 1949:181–182), based on banded birds of known age, indicated there was a high degree of accuracy in differentiating females 1½ years of age from those older. In approximately 97 percent of the cases, a female goose that, in fall or winter, has adult-type tail feathers, adult-type primary feathers, and a closed oviduct is approximately 1½ years old; if she has an open oviduct, she is about 2½ years of age or older. (In a few individuals, the oviduct may open in the second spring of life.)

The Penis.—For most species of geese—and especially for the immatures—determining the presence or absence of a penis is essential to accurate sexing. Eversion of the penis from the cloaca of a male bird

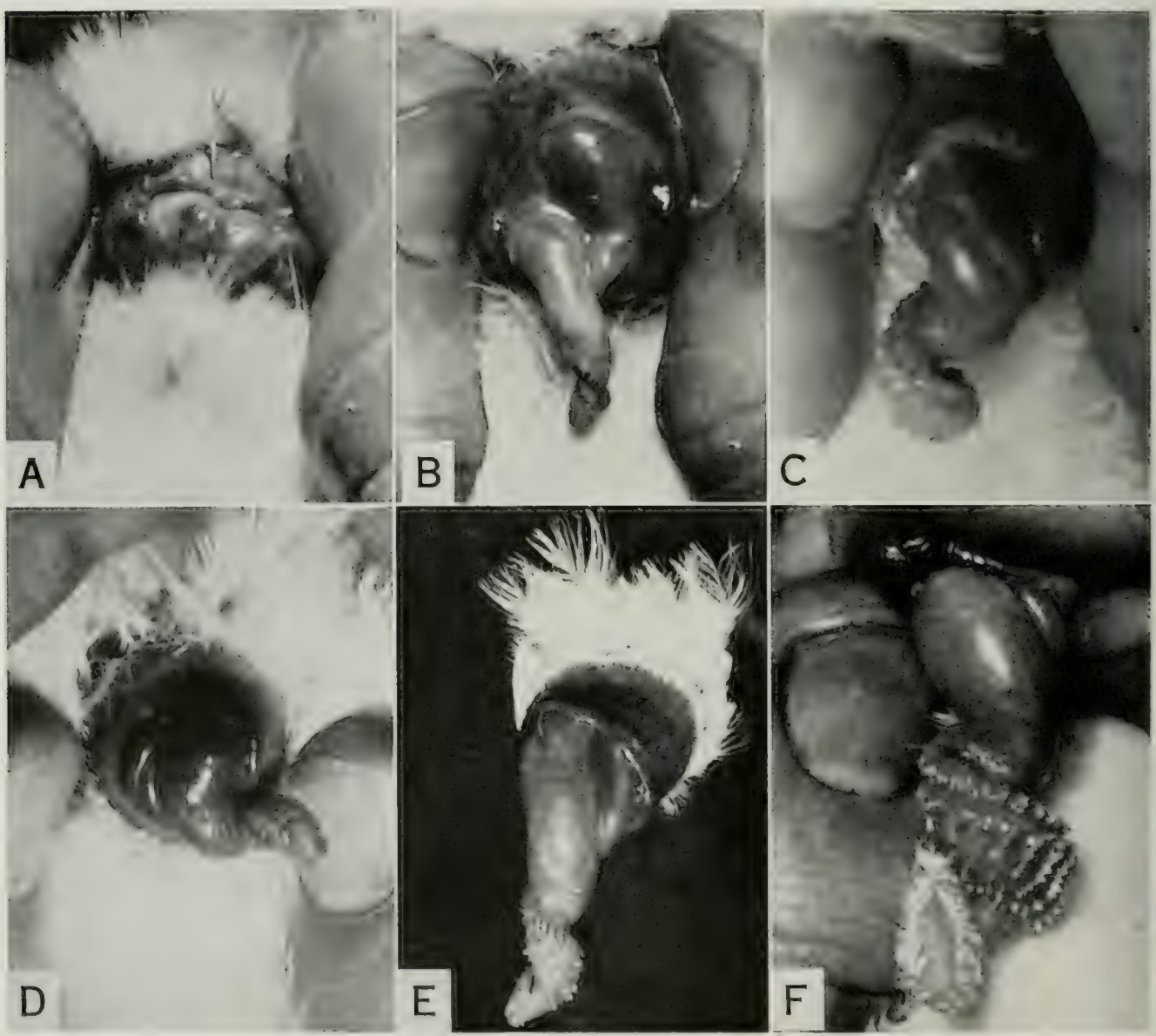


Fig. 12.—Stages of development of the penis of Canada geese as shown by an experiment involving use of light and hormone: *A*, adult male, untreated in early February; *B*, yearling male, March 2, after receiving 16 hours of light a day for 18 days; *C*, captive yearling male, April 11, caged outdoors; *D*, yearling male that received daily, for 4 days, 16 hours of light and gonadotropic hormone; *E*, stage intermediate between *D* and *F*; *F*, yearling male, March 2, after being given 16 hours of light and gonadotropic hormone injections daily for 18 days.

is a simple matter in ducks; in geese, because of the larger size and greater strength of the sphincter muscle, eversion is more difficult. The technique is the same in both cases—application of a firm downward and outward rolling pressure of the thumbs when placed on either side of the sphincter muscle. The forefingers are used to bend the tail back to aid eversion of the cloaca. At the same time an upward pressue is applied from below the bird by a lateral surface of the middle finger of each hand. Experience in sexing geese and in examining the cloaca with the speculum is probably best gained, at first, by working with dead birds.

The presence of an immature penis in a wild goose being examined immediately identifies the bird as an immature male. (Captive geese sometimes develop more slowly than wild geese, and some captive yearling males may have immature penes.) The everted penis of an immature will be seen as a small, corkscrew-shaped organ (about the size of the exposed lead tip of a sharpened pencil) situated in the 8 o'clock position, Fig. 11*A*.

Present in female geese is a small papilla on the internal edge of the sphincter muscle. This papilla, situated in the 6 o'clock position, is minute in immatures but somewhat larger in older females. It is believed to be homologous to the clitoris in mammals.

The penis of the yearling male goose in winter, Fig. 11*B*, can be described as intermediate in size between that of an immature and an adult, Fig. 11*A* and *C*. In the great majority of instances, penis characters, when considered together with the bursa, are useful in distinguishing yearling adults from older adults. The penis in yearlings is about 4 mm in diameter and 10 mm long. Its most salient features, a pale, translucent color and a smooth surface appearance, Fig. 11*B*, tend to give it a rather turgid aspect.

The sheathed and unextended penis in older geese, in winter, is generally one and one-half to two times as large as this organ in typical yearlings. It is usually a darker red than the penis in yearlings and is sometimes tinged with purple, particularly toward the distal end. The surface of the sheath is wrinkled in appearance, and the visible venation is more prominent than that of yearlings.

No discernible change in the development of the penis is seen in wintering immatures prior to northward migration in late February and early March, but in yearlings and adults some enlargement and a tendency to become unsheathed may be noted. By the time Canada geese arrive on the breeding grounds in late April and early May, the penes in all age classes have undergone notable development, Fig. 11*D* and *E*, particularly the penis of the immature. In the 2-month interval between departure from the wintering grounds and arrival on the breeding grounds, the penis of the immature, Fig. 11*D*, undergoes development nearly comparable to that of the adult in spring, Fig. 11*E*. However, the immature still possesses a large bursa, Fig. 10*D*, and in most cases immature tail feathers, which provide incontestable evidence that the bird is, indeed, only a 1-year-old.

The maturation of the penis can be observed in a series of photographs, Fig. 12, taken in the course of an experiment on the effects of increased light and of daily injections of gonadotropic hormones on the maturation process.

DISCUSSION AND SUMMARY

In addition to the principal characters of age and sex discussed above, there are general clues to the age and sex of the bird being handled. For example, birds in the various age and sex classes vary considerably in size. In winter, the weight of an immature *Branta canadensis interior* averages about 1½ pounds less than that of the adult; the weight of a yearling averages one-half pound less. Males are heavier than females by an average of nine-tenths of a pound in the immature and yearling age classes and 1½ pounds in the adult age class. These differentials in weight are reflected in muscular development. With experience, an operator should have a fairly accurate idea of the age and sex of a live goose simply by grasping it by the humeri. The muscles around the humeri of immatures are not fully developed and they feel stringy; those of older geese, particularly adult males, are well developed. The inexperienced can most effectively learn to sex and age geese in fall and winter by using the key below:

1. Some or all tail feathers with notched, worn tips and relatively narrow vanes, Fig. 2*A*, *B*, *D*; color blackish brown 6
   All tail feathers with unnotched, unworn tips and relatively broad vanes, Fig. 2*C*; color black. 2
2. Primaries pointed at tips, Fig. 3*B*. 6
   Primaries obtuse or rounded at tips, Fig. 3*A*. 3
3. Penis present 4
   Penis absent 5
4. External portion of sphincter muscle a pale flesh color; penis intermediate in size, Fig. 11*B*, usually a pale flesh color, translucent and smooth; bursa open and easily probed, usually to a depth of 15–20 mm; spur of each wing smooth and feathered over at tip, Fig. 8*A*. . . . . *yearling male*
   External portion of sphincter muscle dark red or purple; penis large, Figs. 11*C* and 12*A*, dark red or purplish in color, with wrinkled surface and fairly prominent venation; bursa closed or, if open, shallow and probed with difficulty; tip of each wing spur enlarged and knobby at tip and more or less denuded of feathers, Fig. 8*B*. . . . . *adult male*

5. External portion of sphincter muscle, Fig. 10*A*, not much larger than that of immature and light flesh-red in color; oviduct closed at juncture with cloaca; bursa open and easily probed, usually to a depth of 15–20 mm, as in yearling male.....*yearling female*
External portion of sphincter muscle, Fig. 10*B*, much larger than that of either immature or yearling female and dark red or blotched with purple; oviduct open and easily probed; bursa closed or, if open, shallow and probed only with difficulty...*adult female*
6. Penis present, Fig. 11*A*.....*immature male*
Penis absent.....*immature female*

On the breeding grounds, in the spring and summer, the problems of aging geese are more complex and subtle than on the wintering grounds in fall and winter. A male possessing an adult-type tail and a penis that indicates sexual maturity is, nevertheless, only 1 year of age if tips of the primary feathers are pointed, worn, and faded. A year-old female, prior to the molt in her second summer of life, possesses primaries with pointed tips and, with very few exceptions, a closed oviduct. A year-old goose of either sex still retains a large, easily probed bursa.

A 2-year-old goose, after its return to the breeding grounds for the third summer of life, cannot be identified with certainty; in individual cases, however, identification based on a combination of characters may be accurate. An incompletely resorbed bursa together with a normal uninjured wing spur indicates a 2-year-old male; an older male lacks a bursa and, in all probability, has a knobby, enlarged wing spur. A female possessing an open oviduct, a remnant of a bursa, and either a very small or no brood patch may be considered 2 years old. An older female, particularly one in the process of egg-laying, has a flaccid, easily distended sphincter muscle, an enlarged oviduct opening, and a prominent brood patch. In a female of either age class, the presence or absence of a brood patch in midsummer should indicate whether or not the individual had attempted nesting in the current season.

The question has often been posed as to what percent of the 2-year-old females nest in their third spring of life. To determine the answer for a large and widely scattered population would be difficult and expensive. It would be necessary to collect a statistically significant number of females early in the nesting cycle, determine the percentage of 2-year-old females (aged by bursa examination), and then relate the data obtained to the percentage of yearlings identified in the population the previous winter. At the present time, or until more definitive characters of age in breeding geese are found, a program that attempted estimates of this nature for large and widely scattered populations as its chief objective would have dubious merit. On the other hand, a program dealing with a nonmigratory wild population of limited size—a population that could be aged, banded, and subsequently closely observed—would provide information on the percentage of females that nest at 2 years of age. For example, recent studies of refuge populations in the United States indicate that from one-third to two-thirds or more of the 2-year-old females may breed. Doubtless the percentage that breed in any single year is related to the density of older breeding pairs present and to the extent that other pairs have been broken up due to the death of one of the members. Hence, the statistics obtained from any one population would not apply exactly to other populations.

At the present stage of our knowledge, predictions dealing with heavily shot populations should probably be based on the assumption that all females attempt to nest at approximately 2 years of age or in their third spring of life. Predictions of fall populations may be calculated by using an average figure of productivity for all females 2 or more years of age. However, the productivity of 2-year-old females is generally reported to be one bird less than for older females.

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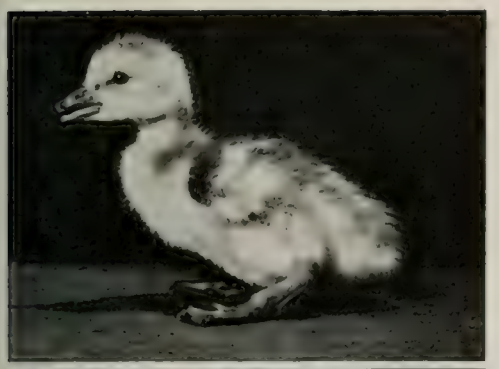
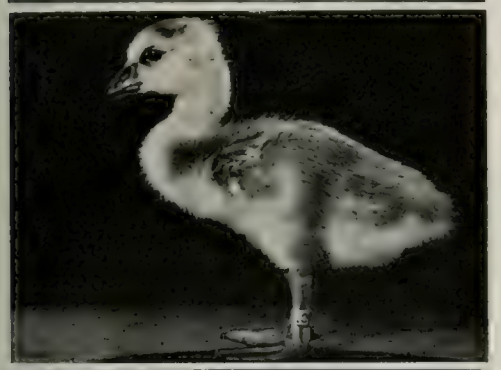


1 day



1 week

2 weeks

3 weeks

4 weeks

5 weeks

6 weeks

7 weeks

8 weeks

10 weeks

Fig. 13. — Developmental stages of the giant Canada goose *(Branta canadensis maxima)* as shown by goslings reared in confinement and fed pelleted food. Ages are as indicated for each stage.

Printed by authority of the State of Illinois, Ch. 127, IRS, Par. 58:12. (2141—4M—6-67)